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Corps of Engineers Painting and Its Compliance With Clean Air Act Regulations

by
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This report assesses the impact of the Clean Air Act (42 U.S.C. 7401 et seq.; P.L. 95-95), and of Army regulations on volatile organic compounds (VOCs) in particular, on Corps of Engineers painting specifications. The researchers reviewed the paints specified in CEGS-09900, *General Painting,* CW-09940, *Painting: Hydraulic Structures and Appurtenant Works,* and CE-R-09.2, *Painting,* and found that many paints did not comply with restrictive regulations on VOC content. For each of these paints, the VOC content is given, and alternate, compliant paints are suggested.

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FOREWORD

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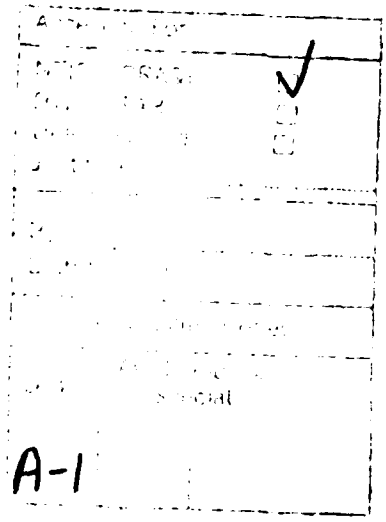

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CORPS OF ENGINEERS PAINTING AND ITS COMPLIANCE WITH CLEAN AIR ACT REGULATIONS

1 INTRODUCTION

Background

Under the Clean Air Act of 1977 (42 U.S.C. 7401 et seq.; P.L. 95-95), the National Primary and Secondary Ambient Air Quality Standards (40 CFR 50) were adopted. This regulation had a statutory deadline of 31 December 1987. By this date, each state had to develop and implement an Environmental Protection Agency (EPA)-approved State Implementation Plan to attain the National Ambient Air Quality Standards. The regulation allows state and local governments to implement additional and more restrictive air pollution requirements for a given area. It is the policy of the Department of Defense (DOD) to take any necessary action to ensure compliance with environmental pollution regulations in effect at facilities under its control.

One aspect of the Clean Air Act regulates the presence of volatile organic compounds (VOCs). These compounds are important constituents of many types of paints and varnishes. They are environmentally undesirable because they react with chemicals in the air to produce smog. In its construction work, the Corps of Engineers uses many VOC-containing materials and, as part of the DOD, must follow its guidance on VOCs in complying with the Clean Air Act. Thus the regulations the Corps must comply with vary widely across the country. Corps contract writers need a reference which identifies which paint systems in the existing Corps painting program may not comply with these varying VOC regulations.

Objectives

- Clarify and interpret the DOD policy regarding specific rules and regulations, both local and Federal, governing VOC coating operations, and make recommendations to Headquarters, U.S. Army Corps of Engineers (HQUSACE) regarding the implementation of this policy.

- Review applicable Corps of Engineers guidance documents, including those for civil works (CW-09940[1]), military construction (CEGS-09900[2]), and Army Reserve (CE-R-09.2[3]), and identify the potential impact of the Federal Clean Air Act on coating specifications in these documents.

- Identify known noncompliant architectural and other miscellaneous metal coatings that contribute to VOC problems.

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[1]Corps of Engineers Guide Specification for Civil Works Construction CW-09940, *Painting: Hydraulic Structures and Appurtenant Works* (August 1981).
[2]Corps of Engineers Guide Specification CEGS-09900, *General Painting* (March 1986).
[3]Corps of Engineers Guide Specification for Army Reserves CE-R-09.2, *Painting* (July 1985).

- Identify potential substitutes for noncompliant coating specifications, including commercially available products.

- Evaluate the impact on the ongoing military construction programs at the installations subject to local environmental regulations.

- Prepare interim guidance for Field Operating Activities (FOA) on achieving compliance with applicable regulations on VOC emission limitations.

- Recommend corrective actions.

Approach

First this report briefly outlines the Clean Air Act and the actions taken by the DOD and the Army to comply with it. Then the DOD's policy on the Act is reviewed. Paints specified in various Corps of Engineers documents are compared to the Belvoir Research, Development, and Engineering Center's *Plan of Action for the Control of FSC 8010* Volatile Organic Compounds in Department of Defense Operations* (10 October 1987). That report gives VOC data for specific paints and compares this data to the California VOC regulations. The present report lists noncompliant paints by type and discusses alternative, compliant paints. It then discusses how the Act affects ongoing projects and lists specific paints from CEGS 09900, their VOC contents, and specific alternatives.

Mode of Technology Transfer

This work has contributed to the *Engineering Improvement Recommendation System (EIRS) Bulletin* 87-03, 26 June 1987.

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*Federal Supply Class (FSC) 8010, Paints, Dopes, Varnishes and Related Products.

2 PROJECT HISTORY

Clean Air Act

Part of the Clean Air Act addresses the problem of VOCs. Only those states that have been identified by the EPA as having ozone nonattainment areas within their jurisdiction must adopt VOC regulations. A nonattainment area is any designated region within a state (county, city, or other state jurisdiction) which has been identified by the EPA as exceeding the National Ambient Air Quality Standard for Ozone. Each state is free to establish those areas under its jurisdiction to which these regulations apply; however, VOC regulations must apply to all nonattainment areas. Any governing body (e.g., a city) may adopt a stricter regulation. Because of this structure, there is a nonstandard application of VOC regulations across the United States. California, with the most stringent regulations, has subdivided the state's regulatory control into 46 districts. Each of these districts has local control and authority over VOC restrictions within its geographical area. Figure 1 shows the diversity of regulatory controls across the United States. This nonuniformity of restrictions presents a problem in providing specifications to be used across these districts.

DOD Policy

A memorandum dated 4 April 1986, from Assistant Secretary of Defense (Office of the Secretary of Defense [OSD]) James P. Wade, Jr. to the Secretaries of the Military Departments and the Director of the Defense Logistics Agency, stated

> In accordance with the Clean Air Act and Executive Order 12088, the Department of Defense is required to comply with applicable pollution control standards. Our policy is to take all necessary actions to abate environmental pollution with respect to federal facilities and other activities under our control.[4]

Additional policy guidance is provided in a similar memorandum from James P. Wade, dated 18 July 1986, which states in part:

> The DOD exercises control over facilities in a number of areas of the U.S. that are classified as nonattainment for ozone. Control of VOCs is an integral part of ozone attainment strategies. DOD policy is not to exceed VOC emission limitations and to implement compliance measures at facilities where emissions limitations are being exceeded, whether or not a formal Notice of Violation has been received. This policy applies to all facilities subject to DOD control.[5]

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[4] Reproduced in *Plan of Action for the Control of FSC 8010 Volatile Organic Compounds in Department of Defense Operations*, Appendix A (Belvoir Research Development and Engineering Center [BRDEC], 10 October 1986).

[5] Reproduced in *Plan of Action for the Control of FSC 8010 Volatile Organic Compounds in Department of Defense Operations*, Appendix A.

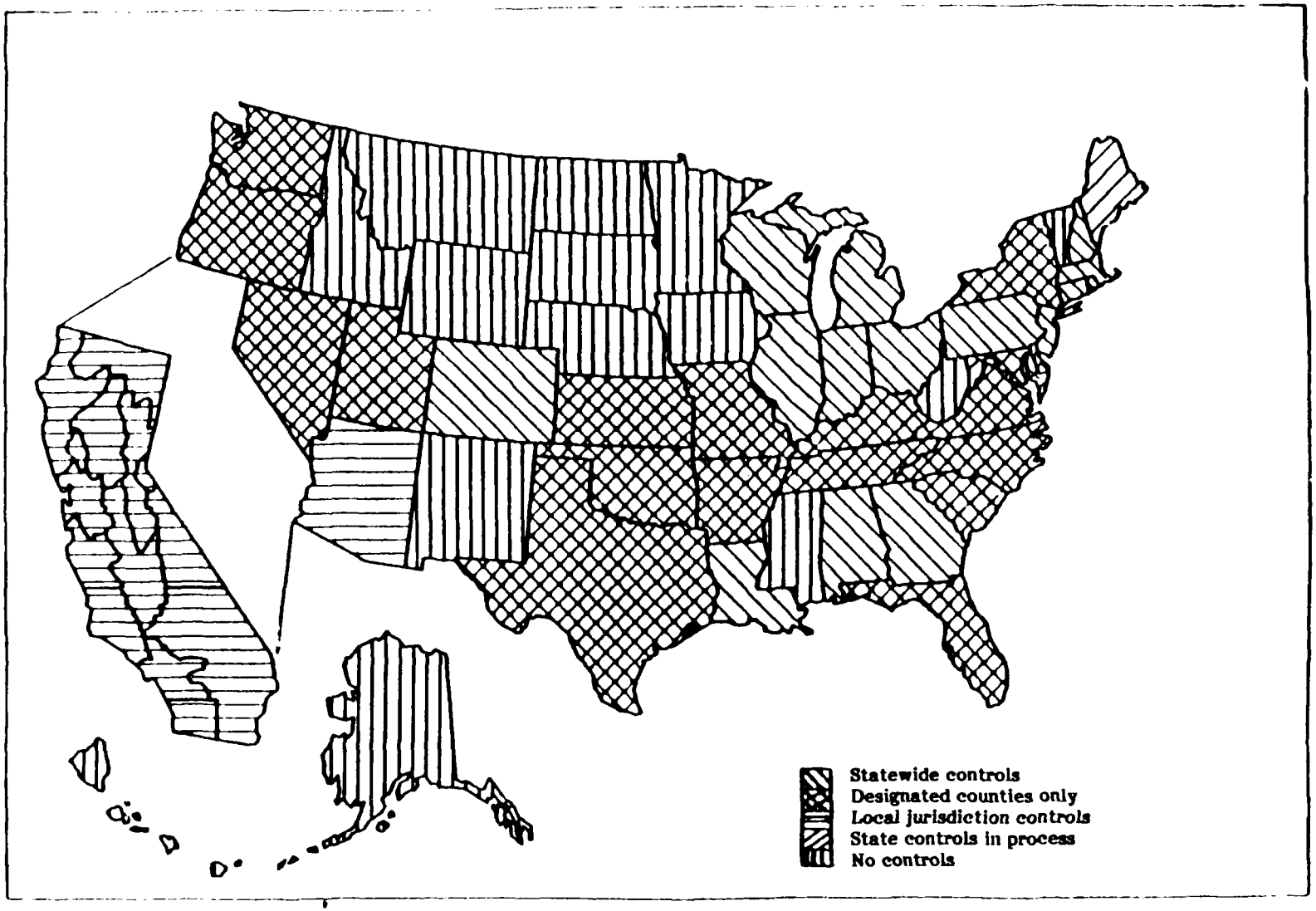

Figure 1. Air quality control regulations across the United States. (Source: *Plan of Action for the Control of FSC 8010 Volatile Organic Compounds in Department of Defense Operations* [Belvoir Research Development, and Engineering Center, 10 October 1986].)

An attachment to the memorandum provided strategy and guidance for the preparation of abatement plans necessary for each facility that has VOC emission compliance problems.

Tasking

In a memorandum dated 7 February 1986, OSD tasked the Department of the Army to lead a working group on "Air Pollution Control of Volatile Organic Compounds (VOCs) from Aerospace Coating Operations." This working group identified the need for a special team to review all specifications in Federal Supply Class (FSC) 8010, *Paints, Dopes, Varnishes and Related Products*, in order to better determine the scope of the VOC problem. In a subsequent memorandum dated 9 April 1986, OSD tasked the Army Materiel Command (AMC), which has responsibility for FSC 8010, to chair this team. AMC further delegated this responsibility through the Troop Support Command to the Belvoir Research, Development, and Engineering Center (BRDEC).

The team was directed to perform the following tasks:

1. Review all FSC 8010 documents to:
   a. Eliminate from review documents for materials which are not related to the problem.
   b. Eliminate from review documents for liquids which do not contribute to VOCs.
   c. Establish VOC-related content of remaining documents.
   d. Categorize VOC sources by use and type, e.g., Aerospace--Topcoat, Architectural--High Build glaze, etc.
   e. Identify documents which should be cancelled or not used for new design.
2. Identify deficiencies in remaining documents.
3. Identify potential substitutes (subject to completion of testing).
4. Identify coatings that cannot be controlled in the near term.
5. Identify research and development (R&D) requirements.
6. Provide a report with recommendations for corrective actions and milestones to the Office of the Assistant Secretary of Defense (Acquisition and Logistics) (OASD[A&L]).

The resulting BRDEC report, *Plan of Action for the Control of FSC 8010 Volatile Organic Compounds in Department of Defense Operations* (10 October 1987), provides the basis for many of the recommendations of this report.

In a letter dated 8 January 1987, from W. McCormick, Jr., the Directorate of Engineering and Construction, Engineering Support Branch (CEEC-ES) asked USA-CERL to prepare a report to help assess the effect of VOC restrictions on the use of architectural coatings systems in Corps of Engineers operations.

3 INTERPRETATION AND IMPLEMENTATION OF DOD POLICY

In basic terms the DOD clean air policy states that the DOD will comply with any and all regulations that have been enacted to bring the air quality of an area into compliance with the Federal Clean Air Act requirements. Regulations have indeed been enacted by states, regions, counties, and even cities. Many state regulations were patterned after an early South Coast (California) requirement known as Rule 66. Rule 66 limited the use of specific photochemical solvents in coatings but did not address the overall quantity of solvent used in the material. These regulations had an impact on meeting the Clean Air Act standards, but in some areas did not reduce the pollution below the limit set by the Act. As a result, the California South Coast Air Quality Management District (SCAQMD) developed a different style of regulation which seeks to reduce the emission of all VOCs. In the area of paint these laws set limits on the amount of solvent, other than water and several other materials, that may be contained in the liquid paint. These limits are stated in terms of grams per liter (g/L) or pounds per gallon (lb/gal) of VOC.

One of the major problems for the Federal government in complying with air quality regulations is their lack of uniformity. As the Rule 66-style laws spread across the country, some governing bodies chose to exempt architectural painting, exempt all government painting, decrease (or increase) the restrictions on a certain solvent, or create any other variation which seemed appropriate for their specific area. This same lack of uniformity appears to be developing with the new VOC-style regulations. Many states exempt portions of the state that are already in compliance with the Clean Air Act standards. Some states exempt sources that emit less than a given amount of VOC per day or per year. Frequently the states that allow these exemptions under their VOC-style regulation still require compliance with an existing Rule 66-style regulation.

A second problem has to do with interpreting a given regulation. For example, if a common Corps civil works vinyl paint used for painting locks and dams is evaluated under the California SCAQMD's rules, it would be considered an architectural coating, and subject to regulation as such. Then, if this paint is considered as a lacquer (under SCAQMD's Rule 1113) it would be limited to a VOC content of 680 g/L*; a specialty primer, sealer or undercoat--350 g/L; a vinyl chloride polymer coating--420 g/L; a quick dry enamel or a waterproof sealer--400 g/L. If instead it were considered to be a quick dry primer, sealer, or undercoat--or if it had metallic pigmentation--it would be completely exempt from the regulation. A clause in the rule states that if more than one standard might be applicable the most restrictive standard shall apply. If this clause were to govern the interpretation, the entire class of vinyl coatings would be eliminated from the market.

At this time, compliance with DOD policy will unfortunately place a sizeable burden on individual DOD installations in the form of a need to determine the requirements of the regulations in effect in the area of the installation. The map (Figure 1) is of very limited value. It does show the states with "No Control," indicating that installations in those states need have no concern about compliance. The other designations simply indicate that controls do exist or are being formulated; they do not indicate the type or extent of regulation. Even where "Statewide Controls" are shown there may be two levels of control reflecting attainment and nonattainment areas of the state. Until Federal specifications are developed to meet the more restrictive VOC-type regulations, installations will be required to evaluate the paints proposed for each project for compliance

*1 g = 0.00220 lb; 1 L = 0.264 gal.

with local regulations. When compliance is a problem, options available to the installation include using some alternate-specification coating, using a proprietary coating which meets the regulation, or obtaining a waiver from the governing body (which the regulation may allow).

The BRDEC *Plan of Action* takes steps that should alleviate problems at some future date. In short, the *Plan* assumes that SCAQMD's regulation is and will continue to be the most restrictive in the country. Specifically, two sections of this regulation were taken as being typical of the most restrictive regulation in the continental United States. These sections are Rule 1107, "Coating of Metal Parts and Products" (Appendix A) and Rule 1113, "Architectural Coatings" (Appendix B). The *Plan* compares the majority of the paint specifications used in the DOD to this regulation. The specifications are then listed as (1) documents without problems, (2) documents to be cancelled, and (3) documents with VOC problems. Obviously the specifications in the first category can continue in use with no change. The paints in this category include many water-thinnable and high-solids coatings as well as coatings that are specifically exempt from the regulation. Many of the paints in the second category do not meet the regulation but alternate paints exist which do. In some cases cancellation is proposed where no alternate paint exists. New paint systems will have to be developed for situations where these paints were used. The last category includes documents specifying paints in which the VOC contents cannot be controlled in the near future. For some of these paints high-solids versions are in the development stage; R&D is recommended or underway on others; and remaining paints are simply listed as not controlled.

4 REVIEW OF CORPS OF ENGINEERS GUIDANCE DOCUMENTS

A review of the applicable specifications listed in CEGS-09900, CW-09940, and CE-R-09.2 (Appendices C, D, and E respectively) indicates VOC problems with a number of coatings. The following paragraphs summarize the noncompliant paints by type, and discuss alternatives and ongoing research.

Exterior gloss and semigloss enamels--TT-E-489, TT-E-490, TT-E-529, TT-E-1593, TT-P-37, TT-P-61: The high solids version of TT-E-489 under development should provide a suitable replacement for many applications. It is assumed that private industry will revise existing specifications for silicone alkyds to provide compliant coatings with superior color and gloss retention.

Exterior primer for wood--MIL-P-28582: Latex primer TT-P-1984 already exists, meets VOC requirements, and could be used on many applications.

Styrene butadine and styrene acrylate paints for masonry--TT-P-97, TT-P-1181: These are not used often and the specifications are under consideration for cancellation. TT-P-19 is a common water-thinnable substitute for these paints in most instances, except where high water impermeability is required.

Floor and deck paints--TT-E-487, TT-P-91: On new construction these coatings can be replaced with epoxy TT-C-535 and TT-C-542 Type II for interior applications and TT-C-542 Type I for exterior applications. The high solids version of MIL-P-24441 epoxy might provide a future alternate coating for exterior use in areas where chalking is not a problem.

Chlorinated rubber paint--SSPC Paint 21: This paint, as well as specification TT-P-95, would be exempt from VOC regulations if manufactured solely for use in swimming pools. Changing the title of TT-P-95 as well as the intended use information would eliminate swimming pool painting compliance problems. Other uses for these paints may be met in many instances through the use of high solids epoxy coatings.

Epoxy coatings--MIL-C-22750, MIL-P-24441 and SSPC Paint 16: The high solids version of MIL-P-24441 should serve as a suitable replacement for many applications of these specifications. The benefits of low cost and high water impermeability of SSPC Paint 16 will be lost.

Vinyl paints--SSPC Paint 9, V-102, V-103, V-106, V-766: These coatings currently do not meet either the requirements of the Rule 66-style or the VOC-style regulations unless they are exempted by some provision of the regulation. Coatings of this type which comply with Rule 66-style regulations are under development. Compliance with VOC-style regulations without a major loss in physical properties is impossible with current technology. If these coatings are not exempted by the regulations, the high solids version of MIL-P-24441 may be usable as an alternate coating in low abrasion areas. Compliant epoxy/urethane systems exist in private industry which would perform in high abrasion areas. However, it is unknown whether they would provide the same specific level of abrasion resistance as the vinyls, and there would be a major sacrifice of application properties as well as potential safety problems associated with chlorinated solvents.

Primers for metal--TT-P-645, DOD-P-15328, SSPC Paint 27: Numerous high solids or metallic pigmented primers for steel exist within the federal specification system as

well as within industry specifications. However, the above paints are also used for priming nonferrous metals, an area of painting for which alternate coatings are not common. At this time no direct replacement for these coatings exists for nonferrous surfaces. Each paint system containing one of these paints will have to be evaluated with regard to substrate and exposure, and a replacement paint system will have to be developed.

Asphalt varnish--TT-V-51: This is a quite specialized, inexpensive coating frequently applied to pipes. If the material is factory-applied, as it frequently is, the factory will have appropriate emission abatement systems to meet the regulations. Where field application is required, increased surface preparation and alternate paint systems will have to be developed based on the anticipated exposure. If the government cancels this specification, it would be desirable for industry to develop a replacement specification for this common factory applied product.

Interior undercoat--TT-E-543, TT-E-545: For most applications these paints can be replaced by the water-thinnable primer sealer TT-P-650.

Interior flat alkyd--TT-P-30: For most applications the water-thinnable TT-P-29 could be specified. Where a high degree of cleanability is desired TT-P-2119 describes a latex paint for high traffic areas.

Interior gloss and semigloss enamels--TT-E-505, TT-E-506, TT-E-508, and TT-E-509 for spray application: The TT-E-509 specification is being revised and should provide a suitable semigloss material. TT-P-1511 describes interior latex gloss and semigloss paints and could be used as an alternate for the above paints in many applications. However, USA-CERL experience has shown that products typically fall short of meeting the gloss portion of this specification.

Sealers and varnishes--TT-S-176, TT-S-179, TT-V-119, TT-V-121, MIL-S-12935, Gym Floor Finishes: There are no known compliant specifications which can be used as direct replacements for these products. Shellac, TT-S-300, is exempt under VOC regulations and may be usable for some sealing applications. Clear versions of TT-C-535 and TT-C-542 exist and appear to be exempt because both basic specifications describe tile-like coatings. They could be specified without a sealer where a high durability gloss coating is desired. Private industry is working on water-thinnable clear coatings but the performance properties of these materials are unknown.

Heat resisting--TT-E-496, TT-P-28: There are no alternate specifications describing black, heat resisting coatings. Private industry manufactures coatings which do comply with the VOC regulations; however, their compliance with the extreme high temperature requirements of TT-P-28 is unknown.

5 IMPACT ON ONGOING PAINTING PROGRAMS

As stated earlier, the VOC regulations are not uniform across the country. As a result, the impact of the regulations will vary from installation to installation. Action at this time should begin with each installation contacting its local EPA to determine if any air pollution control regulations are in effect in the area of the installation. As indicated by the map (Figure 1), a significant area of the country has no regulations. In addition, many of the states having regulations only apply the restrictive, VOC-type regulations to their nonattainment areas (usually major metropolitan areas). Since most Corps installations are in rural areas it can be assumed that many will not come under these regulations. If an installation finds it does come under the requirements of a local VOC regulation, it should obtain the regulation to determine what specific restrictions and exemptions exist. A common exemption is one for sources that emit less than 100 tons (or some other number) of VOC per year. Such a regulation could have the effect of exempting all architectural painting, or indeed all painting, for a regulated installation.

Installations which fall under the full impact of the most restrictive regulations (for example, those in California) are probably already aware of them and have made appropriate paint substitutions in their painting contracts. Where this action has taken place, there will be no further impact unless more restrictive regulations are enacted or official guidance is changed. Where it has not, the installation will have to compare each paint system proposed for use with the local regulation and substitute compliant coatings wherever necessary.

USA-CERL's contact with military construction projects indicates that most high volume painting (exterior and interior of buildings) is already being accomplished with water-thinnable paint systems. Impact on these painting projects will largely consist of locating suitable replacements for gloss and semigloss enamels. As discussed in Chapter 4, replacement specifications for these coatings either exist or are already in the development stage.

Civil works projects involve major quantities of vinyl paints. Since most civil works projects are located in rural areas, it is assumed they will be largely exempted from regulations. However, where the projects are in regulated areas the substitution of paints will result in coatings without the properties of the vinyls. These alternate coatings may reduce the service life or impose additional restrictions on application equipment or temperature conditions. The full impact of such substitutions will vary from installation to installation.

The Painting Schedule of CEGS-09900 was evaluated (see Appendix F) for compliance with the SCAQMD Rule 1107 (see Appendix A). Paints listed in Appendix C as not complying with the regulation or as being "not controlled" are highlighted in the schedule and referenced below. VOC quantities listed below are taken from the BRDEC *Plan of Action*. It should be stressed that the following suggested replacement guidance is only intended as interim guidance for those installations falling under the most restrictive regulations. It is not intended to serve as a basis for revision of the guide specification. In view of the nonuniform implementation of VOC regulations across the country and ongoing R&D efforts by specification-preparing activities to provide lower VOC coating specifications in the near future, it is not felt that revision of the guide specification is appropriate at this time since the new specification would soon be out of date again. However, when R&D has generated new, lower-VOC paint specifications, a major revision of the guide specification will be required.

The following list can be used in conjunction with either Appendix C or F to evaluate the VOC status of a paint being considered. If the paint in question is crossed out on the Painting Schedule in Appendix F, or if it has "no" in either the "Rule-66" or "VOC-style" columns of Appendix C, the paint may present a compliance problem. If so, the list below can be consulted. It gives the VOC content of the paint, which can be compared to the amount specified in the applicable local regulations. The paint may be acceptable locally, even though it does not comply with the strictest VOC regulation. Alternative, compliant paints are also given, with a discussion of the uses for which they are suitable.

Exterior Oil paints: TT-P-102, TT-P-31, TT-P-37, TT-P-19, TT-E-489 (paragraph 8.2 of CEGS-09900). TT-P-102 has an application VOC of 3.5 lb/gal and may be used for white and light tints. TT-P-31 has a package VOC of 1.1 lb/gal and may be used for reds and browns. TT-P-37 has a package VOC of 3.83 lb/gal, may not meet regulations and is recommended for cancellation. Where deep-toned colors are required, the water-thinnable TT-P-19 may be substituted on wood and hardboard. A high solids version of TT-E-489, currently under development, should soon be available as a general replacement.

MIL-P-28582 has a package VOC content of 3.7 lb/gal.* The BRDEC report recommended R&D for FY88. In the interim the water thinnable TT-P-1984 or alternative commercial products may be used.

SSPC-Paint 9 has a package VOC of 6.8 lb/gal. It does not meet the Rule-66 style regulations. R&D is recommended to revise the specification. In the interim a replacement paint system consisting of an inorganic zinc primer, epoxy intermediate coat, and urethane topcoat should be considered.

SSPC-Paint 21 Type I is a silicone alkyd specification having varying VOC contents depending on color. There are two similar Government specifications: TT-E-490 has a package VOC of 3.75 lb/gal and TT-E-1593 has a package VOC of 4.38 lb/gal. Both of these specifications are recommended for cancellation. Where superior color and gloss retention are not required, TT-E-489 may be used.

SSPC-Paint 27, equivalent to Government specification DOD-P-15328, has a package VOC of 6.32 lb/gal. Cancellation has been recommended for the government specification. In localities where this product does not meet regulations alternate paint systems will have to be developed.

TT-E-487 has a package VOC of 3.83 lb/gal. Reformulation is recommended. No other floor and deck enamels are available within the Federal Government system. However, similar proprietary products should be available from local paint manufacturers to meet the regulations. TT-C-535 (epoxy) and TT-C-542 Type II (urethane) may be used as alternate interior coatings, and TT-C-542 Type I can be used for exterior applications on previously uncoated substrates, but these coatings may cause lifting if applied over existing TT-E-487.

TT-E-489 has a package VOC of 4.0 lb/gal and an application VOC of 4.3 lb/gal. A high solids version is currently under development. In the interim TT-P-102 and TT-P-31 may be used for some colors. Proprietary products should be available from local paint manufacturers to provide additional colors which meet the regulations.

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*1 lb = 453 g; 1 gal = 3.785 L.

TT-E-543 and TT-E-545 have package VOCs of 3.33 and 3.42 respectively. Cancellation of TT-E-543 has been recommended. TT-E-545 is being revised. TT-P-650 is a suitable alternate material for interior wood, hardboard, plaster, and gypsum board. Where metal is to be painted, an alternate system is comprised of two coats of MIL-P-28577 followed by a single topcoat of semigloss MIL-P-28578.

TT-P-28 has a package VOC of 4.4 lb/gal and an application VOC of 4.5 lb/gal. There is no specification for an alternate material. Proprietary products are available from major manufacturers which will provide an aluminum finish and resistance to high temperatures; however, compliant products which meet the 1200 °F (642 °C) temperature resistance of this specification are unknown.

TT-P-30 has a package VOC of 4.17 lb/gal. Cancellation of the specification has been recommended. Suitable replacements include water thinnable TT-P-29 for general applications and TT-P-2119 in high traffic areas.

TT-P-91 has a package VOC of 4.42 lb/gal. If this does not comply with local regulations an alternative type of material, such as a high solids epoxy, will have to be specified.

TT-P-95 is exempted from regulations only if it is used solely for painting swimming pools. TT-C-535 epoxy is a suitable alternate for coating interior high traffic and frequently wetted areas.

TT-P-645 has a package VOC of 3.71 lb/gal. R&D is recommended to revise the specification. At this time there are no alternative government specification paints. Whether there are suitable alternative coatings from private industry with proven performance is unknown.

TT-S-176 has a package VOC of 4.33 lb/gal. Cancellation of the specification has been recommended. In some applications it may be replaced with TT-S-300 (shellac); in other applications TT-C-542 (urethane) may be specified. Where oleoresinous type gym floor finish is to be applied as a finish coat, the manufacturer's recommendations regarding primer selection should be followed.

TT-T-496 has a package VOC of 4.17 lb/gal. There are no specifications for an alternate material. Proprietary products which meet the regulations are available from major manufacturers.

TT-V-51 has a package VOC of 4.42 lb/gal. Cancellation of the specification has been recommended. Where this material cannot be used a ferrous-metal primer should be specified (see paragraph 8.3 of CEGS-09900).

TT-V-121 and TT-V-119 have package VOCs of 3.42 and 3.08 lb/gal respectively. Cancellation of TT-V-121 has been recommended. TT-P-119 is being reformulated to comply with the regulations. The BRDEC report indicates TT-V-109 and TT-V-85 meet VOC requirements and could be specified as alternate coatings.

Oleoresinous-type gymnasium floor finishes must meet the requirements of the Maple Flooring Manufacturers Association Specification, according to paragraph 8.8. In areas where VOC regulations are in effect the paragraph should be expanded to require coatings to comply with the regulations.

6 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Under the Clean Air Act, California has the strictest VOC regulations. Although there is no requirement that the regulations be uniform, VOC regulations similar to those now in effect in California will probably be enacted in other nonattainment areas across the country. It is the stated policy of the DOD to comply with all local regulations. At present, however, the wide variation in these local regulations makes it difficult to develop official, uniform specifications.

As discussed in Chapter 4, many of the paints called for in Corps of Engineers guide specifications do not meet the requirements of the VOC regulations. Appendices C, D, and E list these paints. When Corps of Engineers painting is to be performed in an area where restrictive regulations exist, alternate paints must be specified. Replacements for some of the noncompliant paints are suggested in Chapter 5. Not all paints have direct replacements within the Federal specification system, and in some cases no direct replacement exists.

Recommendations

To attain compliance with VOC regulations as required by DOD policy, a two-step approach is recommended. In the first step, installations should modify existing guidance as necessary to meet the regulations in their particular area. Each installation should contact the state EPA to determine if any air pollution regulations are in effect in the area of the installation. Existing regulations should be obtained and reviewed to determine what specific restrictions and exemptions exist. If it is found that the regulation precludes the use of a paint in the current Army guide specification, an alternate paint should be specified.

In the second step, the Corps of Engineeers' painting guide specifications should be thoroughly revised so that a single guide specification may again be used nationwide. The suggested revision should not be a simple replacement of a compliant paint for a noncompliant one, but rather a major overhaul of all paint systems, including both the surface preparation and the type of coatings used. To do this, these steps must be taken:

- VOC regulations from numerous governing bodies must be reviewed to determine the most restrictive requirement of each.
- Paint specifications, whether industry specifications, Federal specifications, or commercial item descriptions, must be in place so they may be called for in the new guidance.
- The new guidance should seek to minimize the number of paints used. The new paints specified should use the latest paint technology. Each entire paint system should be evaluated, including not only the paint but the surface preparation, paint application, and inspection.
- In view of the scope of the recommended revision, it is suggested that the revised guidance be field tested at selected installations prior to full scale implementation.

APPENDIX A:

SCAQMD RULE 1107, COATING OF METAL PARTS AND PRODUCTS

(Adopted June 1, 1979)(Amended December 4, 1981)(Amended May 7, 1982)
(Amended December 2, 1983)(Amended March 2, 1984)(Amended January 9, 1987)
(Amended June 5, 1987)

RULE 1107. COATING OF METAL PARTS AND PRODUCTS

(a) Definitions

For the purpose of this Rule, the following definitions shall apply:

(1) Adhesive is any substance that is used to bond surfaces together by attachment.

(2) Aerosol-Spray Coating is a coating which is sold in a hand-held, pressurized container and which is expelled from the container in a finely divided spray when a valve on the container is depressed.

(3) Air-Dried Coating is a coating that is cured at a temperature below 90°C (194°F).

(4) Baked Coating is a coating that is cured at a temperature at or above 90°C (194°F).

(5) Camouflage Coating is a coating used, principally by the military, to conceal equipment from detection.

(6) Coating is a material which is applied to a surface and which forms a continuous film in order to beautify and/or protect such surface.

(7) Contract Painter is a non-manufacturer of metal parts and products who applies coatings to such products at his facility exclusively under contract with one or more parties that operate under separate ownership and control.

(8) Electric-Insulating Varnish is a non-convertible-type coating applied to electric motors or components of electric motors.

(9) Etching Filler is a coating that contains less than 23 percent solids by weight and at least 1/2 percent acid by weight, and is used instead of applying a pretreatment coating followed by a primer.

(10) Exempt Compounds are any of the following compounds: 1,1,1-trichloroethane, methylene chloride, trifluoromethane (FC-23), trichlorotrifluoroethane (CFC-113), dichlorodifluoromethane (CFC-12), trichlorofluoromethane (CFC-11), chlorodifluoromethane (CFC-22), dichlorotetrafluoroethane (CFC-114), and chloropentafluoroethane (CFC-115).

(11) High-Temperature Coating is a coating that is certified to withstand a temperature of 1000°F for 24 hours.

(12) Extreme High-Gloss Coating is a coating which, when tested by the American Society for Testing Materials Test Method D-523 adopted in 1980, shows a reflectance of 75 or more on a 60° meter.

(13) Extreme-Performance Coating is a coating used on a metal surface where the coated surface is, in its intended use, exposed to any of the following:

(A) Industrial-grade detergents, cleaners, or abrasive scouring agents;

(B) Unprotected shipboard conditions; or

(C) Other similar environmental conditions as determined by the Executive Officer.

(14) "Grams of VOC per Liter of Coating Less Water and Less Exempt Compounds" is the weight of VOC per combined volume of VOC and coating solids and can be calculated by the following equation:

$$\text{Grams of VOC per Liter of Coating Less Water and Less Exempt Compounds} = \frac{W_s - W_w - W_{es}}{V_m - V_w - V_{es}}$$

Where: W_s = weight of volatile compounds in grams
W_w = weight of water in grams
W_{es} = weight of exempt compounds in grams
V_m = volume of material in liters
V_w = volume of water in liters
V_{es} = volume of exempt compounds in liters

(15) "Grams of VOC per Liter of Material" is the weight of VOC per volume of material and can be calculated by the following equation:

$$\text{Grams of VOC per Liter of Material} = \frac{W_s - W_w - W_{es}}{V_m}$$

Where: W_s = weight of volatile compounds in grams
W_w = weight of water in grams
W_{es} = weight of exempt compounds in grams
V_m = volume of material in liters

(16) Heat-Resistant Coating is a coating that must withstand a temperature of at least 400°F during normal use.

(17) High-Performance Architectural Coating is a coating used to protect architectural subsections and which meets the requirements of the Architectural Aluminum Manufacturers Association's publication number AAMA 605.2-1980.

(18) Ink is a fluid that contains dyes and/or colorants and is used to make markings but not to protect surfaces.

(19) Magnetic Data Storage Disk Coating is a coating used on a metal disk which stores data magnetically.

(20) Metal Particles are pieces of an elemental pure metal or a combination of elemental metals.

(21) Metal Parts and Products are any components or complete units fabricated from metal, except those subject to the coating provisions of other source specific rules of Regulation XI.

(22) Metallic Coating is a coating which contains more than 5 grams of metal particles per liter of coating, as-applied.

(23) Military Specification Coating is a coating applied to metal parts and products and which has a paint formulation approved by a United States Military Agency for use on military equipment.

(24) Mold-Seal Coating is the initial coating applied to a new mold or a repaired mold to provide a smooth surface which, when coated with a mold release coating, prevents products from sticking to the mold.

(25) Motor Vehicle is a passenger car, light-duty truck, medium-duty vehicle, or heavy-duty vehicle as defined in Section 1902, Title 13, of the California Administrative Code.

(26) Motor Vehicle Rework is the reconditioning of motor vehicles.

(27) Pan-Backing Coating is a coating applied to the surface of pots, pans, or other cooking implements that are exposed directly to a flame or other heating elements.

(28) Prefabricated Architectural Component Coatings are coatings applied to metal parts and products which are to be used as an architectural structure.

(29) Pretreatment Coating is a coating which contains no more than 12 percent solids by weight, and at least 1/2 percent acid, by weight, is used to provide surface etching, and is applied directly to metal surfaces to provide corrosion resistance, adhesion and ease of stripping.

(30) Reactive Diluent is a liquid which is a VOC during application and one in which, through chemical reaction such as polymerization, 20 percent or more of the VOC becomes an integral part of a finished coating.

(31) Repair Coating is a coating used to recoat portions of a product which has sustained mechanical damage to the coating following normal painting operations.

(32) Safety-Indicating Coating is a coating which changes physical characteristics, such as color, to indicate unsafe conditions.

(33) Silicone-Release Coating is any coating which contains silicone resin and is intended to prevent food from sticking to metal surfaces such as baking pans.

(34) Solar-Absorbent Coating is a coating which has as its prime purpose the absorption of solar radiation.

(35) Solid-Film Lubricant is a very thin coating consisting of a binder system containing as its chief pigment material one or more of molybdenum disulfide, graphite, polytetrafluoroethylene (PTFE) or other solids that act as a dry lubricant between faying surfaces.

(36) Stencil Coating is an ink or a coating which is rolled or brushed onto a template or stamp in order to add identifying letters and/or numbers to metal parts and products.

(37) Textured Finish is a rough surface produced by spraying large drops of coating onto a previously applied coating.

(38) Touch-Up Coating is a coating used to cover minor coating imperfections appearing after the main coating operation.

(39) Transfer Efficiency is the ratio of the weight or volume of coating solids adhering to an object to the total weight or volume, respectively, of coating solids used in the application process, expressed as a percentage.

(40) Vacuum-Metalizing Coating is the undercoat applied to the substrate on which the metal is deposited or the overcoat applied directly to the metal film.

(41) Volatile Organic Compound (VOC) is any volatile compound of carbon, excluding methane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, ammonium carbonate, 1,1,1-trichloroethane, methylene chloride, trifluoromethane (FC-23),

trichlorotrifluoroethane (CFC-113), dichlorodifluoromethane (CFC-12), trichlorofluoromethane (CFC-11), chlorodifluoromethane (CFC-22), dichlorotetrafluoroethane (CFC-114), and chloropentafluoroethane (CFC-115).

(b) Requirements

(1) Transfer Efficiency

A person shall not apply coatings to metal parts and products subject to the provisions of this Rule except by using properly operated equipment and by:

(A) Electrostatic attraction, or

(B) Flow coat, or

(C) Dip coat, or

(D) Such other coating application methods as are demonstrated to the Executive Officer to be capable of achieving at least 65 percent transfer efficiency and for which written approval of the Executive Officer has been obtained.

(2) VOC Content of Coatings

On or after June 1, 1987, a person shall not apply to metal parts and products any coatings, including any VOC-containing materials added to the original coating supplied by the manufacturer, which contain VOC in excess of the limits specified below:

	Limits Grams of VOC Per Liter of Coating, Less Water and Less Exempt Compounds			
Coating	Air Dried	(lb/gal)	Baked	(lb/gal)
General	340	(2.8)	275	(2.3)
Military Specification	340	(2.8)	275	(2.3)
Etching Filler	720	(6.0)	720	(6.0)
Solar-Absorbent	420	(3.5)	360	(3.0)
Heat-Resistant	420	(3.5)	360	(3.0)
Extreme High-Gloss	420	(3.5)	360	(3.0)
Metallic	420	(3.5)	420	(3.5)
Extreme-Performance	420	(3.5)	360	(3.0)
Prefabricated Architectural Component	420	(3.5)	275	(2.3)
Touch Up	420	(3.5)	360	(3.0)
Repair	420	(3.5)	360	(3.0)
Silicone Release	420	(3.5)	420	(3.5)
High-Performance Architectural	750	(6.3)	750	(6.3)
Camouflage	420	(3.5)	420	(3.5)
Vacuum-Metalizing	800	(6.7)	800	(6.7)
Mold-Seal	750	(6.3)	750	(6.3)
High-Temperature	720	(6.0)	720	(6.0)
Electric-Insulating Varnish	620	(5.2)	620	(5.2)
Pan-Backing	480	(4.0)	480	(4.0)

(3) On or after June 1, 1987, a person shall not use VOC-containing materials which have a VOC content of more than 200 grams per liter of material for surface preparation or cleanup and stripping of coating, excluding cleaning of coating-application equipment.

(4) On or after June 1, 1987, closed containers shall be used for disposal of cloth or paper used for surface preparation, cleanup and paint removal.

(5) On or after June 1, 1987, a person shall not use VOC-containing materials for the cleanup of equipment used in coating operations unless:

(A) the VOC is collected in a container which is closed when not in use, and is properly disposed of, such that the VOC is not emitted into the atmosphere; or

(B) the spray equipment is disassembled and cleaned in a solvent vat and the vat is closed when not in use; or

(C) the cleanup materials contain no more than 200 grams of VOC per liter of material.

(6) For coatings that contain reactive diluents, the VOC content of the coating is determined after curing. The grams of VOC per liter of coating shall be calculated by the following equation:

$$\text{Grams of VOC per Liter of Coating Less Water and Less Exempt Compounds} = \frac{W_s - W_w - W_{es}}{V_m - V_w - V_{es}}$$

Where: W_s = weight of volatile compounds not consumed during curing, in grams

W_w = weight of water not consumed during curing, in grams

W_{es} = weight of exempt compounds not consumed during curing, in grams

V_m = volume of the material prior to reaction, in liters

V_w = volume of water not consumed during curing, in liters

V_{es} = volume of exempt compounds not consumed during curing, in liters

(7) On or after June 1, 1987, a person may apply to metal parts and products any coating used to match the existing coating of motor vehicles (including any VOC-containing materials added to the original coating as supplied by the manufacturer) if such coating does not contain in excess of:

(A) 520 grams of VOC per liter of coating, less water and less exempt compounds, for general coatings; or

(B) 600 grams of VOC per liter of coating, less water and less exempt compounds, for metallic coatings; and

provided that the applicator submits a written request to the Executive Officer demonstrating to the Executive Officer's satisfaction

the need to apply such coating and the applicator receives from the Executive Officer written approval to use such coatings.

(c) Prohibition of Specifications
A person shall not specify the use in the District of any coating to be applied to any metal parts and products subject to the provisions of this Rule that does not meet the limits and requirements of this Rule. The requirements of this paragraph shall apply to all written or oral contracts.

(d) Methods of Analysis
The volatile organic content of coatings subject to the provisions of this Rule shall be determined by the procedure outlined in the District's "Laboratory Methods of Analysis for Enforcement Samples" manual.

(e) Exemptions
(1) The provisions of subparagraphs (b)(1) and (b)(2) of this Rule, shall not apply to:
(A) Stencil coatings;
(B) On and after September 1, 1987, a facility which uses a total of less than one gallon of coating, including any VOC-containing materials added to the original coating as supplied by the manufacturer, subject to this Rule, in any one day;
(C) Coatings used in volumes less than 50 gallons in any one year, if compliant coatings are not available;
(D) Pretreatment coatings;
(E) Safety-indicating coatings;
(F) Aerosol-spray coatings;
(G) Magnetic data storage disk coatings;
(H) Solid-film lubricants;
(I) Adhesives;
(K) The coating of marine vessels and their structural appurtenances;
(L) The coating of motor vehicle bodies at motor vehicle rework facilities.

(2) The provisions of subparagraph (b)(1) of this Rule shall not apply to any coating operation that, because of physical and/or chemical characteristics of the substrate or safety conditions, cannot meet a 65 percent transfer efficiency, provided that:
(A) A general coater submits a written petition to the Executive Officer setting forth the basis, including test data, for the claim that 65 percent transfer efficiency cannot be met, and approval is granted by the Executive Officer.
(B) A contract painter submits a written petition to, and receives approval from, the Executive Officer to exempt the coating of such items; and the contract painter maintains a daily log:
(i) which describes the reason(s) why 65 percent transfer efficiency cannot be achieved, including a written and/or photographic description of the object to be used; and

(ii) into which the entry is made prior to commencement of coating operations for that object; and
(iii) which is made available for review by the District upon request; and
(iv) which is retained in the operator's files for at least two years.

(3) The Executive Officer may revoke the approval granted pursuant to subparagraph (e)(2)(B) of this Rule if:
(A) the daily log is not adequately maintained; or
(B) an entry is made after the application of coating; or
(C) the physical characteristics of the substrate do not warrant an exemption.

(4) The provisions of subparagraph (b)(1) of this Rule shall not apply to contract painters while applying coatings to objects on trays, provided no object has any dimension greater than 12 inches.

(5) The provisions of subparagraph (b)(1) of this Rule shall not apply to the application of touch-up coatings, repair coatings, textured coatings, metallic coatings which have a metallic content of more than 30 grams per liter, mold-seal coatings, and to facilities that use less than three gallons of coating, as applied, including any VOC-containing materials added to the original coating as supplied by the manufacturer, per day.

(6) The provisions of subparagraph (b)(3) of this Rule do not apply to the preparatory surface cleaning of solar cells and laser optics.

(7) The provisions of subparagraphs (b)(1), (b)(2), and (b)(3) of this Rule do not apply to the application of coatings and use of cleaning solvents while conducting performance tests on the coatings at paint manufacturing facilites.

(f) Rule 442 Applicability
Any coating, coating operation, or facility which is subject to this Rule shall comply with the provisions of Rule 442 until such time as compliance with the limits specified in this Rule is achieved. Any coating, coating operation, or facility which is exempt from all or a portion of the VOC limits of this Rule shall comply with the provisions of Rule 442.

(g) Alternative Emission Control Plan
An owner/operator may achieve compliance with paragraph (b) by achieving equivalent VOC emission reductions obtained by alternative control methods, provided the applicant submits an Alternative Emission Control Plan that is enforceable by the District on a daily basis and receives approval in writing from the Executive Officer prior to implementation. The Alternative Emission Control Plan shall:

(1) Contain, as a minimum, all data, records, and other information necessary to determine eligibility for alternative emission control including, but not limited to:
(A) A list of equipment subject to alternative emission control; and
(B) Daily hours of utilization for applicable equipment; and
(C) Estimated emission of VOC for each operation on a daily basis.

(2) Present the methodology for estimation of equivalency of emission reductions under the proposed Alternative Emission Control Plan as compared to either the emission reductions required by the applicable rules or to actual emissions, whichever is less.
(3) Demonstrate to the satisfaction of the Executive Officer that the difference between the emissions allowed by existing regulations and any lower actual emissions will not be used to increase emissions from the same or another source.
(4) Demonstrate that the permit units subject to the specified rule emission limitations are in compliance with, or on an approved schedule for compliance with, all applicable District rules.
(5) Be submitted as an updated or modified Alternative Emission Control Plan:
(A) Prior to modification of equipment subject to alternative emission control; or
(B) Within sixty (60) days following the date this Rule is amended.

(h) Qualification for Classification as Extreme-Performance Coating
A coating may be classified as an extreme-performance coating provided that the applicator requests and receives written approval of such classification from the Executive Officer prior to application of such coating, and shows that intended use of each coated object would require coating with an extreme-performance coating.

(i) Daily Record of Coating and Solvent Usage
A person who applies coatings and/or solvents to metal parts and products shall maintain a daily record of coating and solvent usage. The record shall be compiled daily for that day's operation, and shall include, but not be limited to:
(1) The amount and type of coating used by each piece of application equipment; and
(2) The amount of VOC in each coating and the volume of each coating at time of application; and
(3) The amount of solvent and exempt compound used; and
(4) The VOC content of each solvent.

(j) Notwithstanding subparagraph (i) above, upon prior written approval of the Executive Officer, any other data may be used to calculate the daily coating and solvent use and daily VOC emission.
Such records shall be retained in the operator's files for two years and be made available for review by the District upon request. Copies of such records shall be supplied to a District representative upon request of the representative.

APPENDIX B:

SCAQMD RULE 1113, ARCHITECTURAL COATING

(Adopted Sept. 2, 1977)(Amended Dec. 2, 1977)(Amended Feb. 3, 1978)
(Amended Sept. 5, 1980)(Amended Apr. 3, 1981)(Amended July 3, 1981)
(Amended by the Calif. ARB Oct. 21, 1981)(Amended Aug. 5, 1983)
(Amended Mar. 16, 1984)(Amended Aug. 2, 1985)(Amended Nov. 1, 1985

December 30, 1986

PROPOSED AMENDED RULE 1113. ARCHITECTURAL COATINGS

(a) (1) A person shall not sell, offer for sale, or apply any architectural coating manufactured after December 31, 1981 which:

(A) contains more than 250 grams of volatile organic compounds per liter of coating (2.08 pounds per gallon), excluding water and any colorant added to tint bases, except as provided in subsection (a)(2); or

(B) contains more than 380 grams of volatile organic compounds per liter of coating (3.17 pounds per gallon), excluding water and any colorant added to tint bases, is defined as a non-flat coating, and is manufactured prior to September 2, 1989; or

(C) is recommended for use as a bituminous pavement sealer, unless it is an emulsion-type coating.

(2) A person shall not sell, offer for sale, or apply any architectural specialty coating which exceeds the following limits (expressed as grams of VOC per liter of coating as applied, excluding water) manufactured after the date listed below:

	Effective Sept. 1, 1984	Effective Sept. 1, 1986	Effective Sept. 1, 1987
Varnish	500	---	350
Lacquer	---	---	680
Semitransparent Stains	---	---	350
Opaque Stains	---	---	350

Semitransparent and Clear			
Wood Preservatives	---	---	350
Opaque Wood Preservatives	400	---	350
General Primers, Sealers			
and Undercoaters	400	---	350
Specialty Primers, Sealers,			
and Undercoaters	---	---	350
Industrial Maintenance			
Primers and Topcoats*			
Alkyds	500**	420	420
Catalyzed Epoxy	500**	420	420
Bituminous Coatings Materials	---	---	420
Inorganic Polymers	---	---	420
Vinyl Chloride Polymers	---	---	420
Chlorinated Rubber	---	---	420
Acrylic Polymers	---	420	420
Urethane Polymers	---	420	420
Silicones	---	---	420
Unique Vehicles	---	---	420
Dry-Fog Coatings			
Flats	550	---	420
Non-Flats	420	---	400
Quick-Dry Enamels	---	---	400
Specialty Flats	---	---	400
Waterproof Sealers	---	---	400
Concrete-Curing Compounds	---	---	350
Roof Coatings	---	---	300

Waterproofing Mastic Coatings	---	---	300
Enamel Undercoaters	450	---	350
Traffic Paints			
For Public Streets and Highways	415	---	250
For Other Surfaces	250	---	250
Black Traffic Coatings	---	---	250

*A coatings category is determined by the generic polymer component present in the finished product in the largest quantity by weight.

**This limit shall become effective on September 1, 1985.

(b) The provisions of section (a) of this Rule shall not apply to architectural coatings sold in this District for shipment outside of this District or for shipment to other manufacturers for repackaging.

(c) The provisions of section (a) shall not apply to:

(1) architectural coatings supplied in containers having capacities of one liter or less; or

(2) architectural coatings recommended by the manufacturer for use solely as one or more of the following:

(A) fire retardant coatings;

(B) tile-like glaze coatings;

(C) mastic texture coatings;

(D) metallic pigmented coatings;

(E) swimming pool paints;

(F) multi-color paints;

(G) quick-dry primers, sealers and undercoaters;

(H) shellac;

(I) sign (graphic arts) coatings;

(J) bond breakers;

(K) below-ground wood preservative coatings; or

(L) dry-fog coatings (until September 1, 1984).

(d) In order to maintain an exemption beyond December 31, 1983, a business granted an exemption pursuant to subsection (a)(2) and (c)(2) of this Rule shall, within three months after the end of each calendar year, commencing with 1983, file with the Executive Officer a report of the annual sales in gallons in California of the following coatings:

(1) Specialty flat coatings;

(2) Quick-dry enamels;

(3) Enamel undercoaters;

(4) Quick-dry primers, sealers, and undercoaters; and

(5) Specialty primers, sealers, and undercoaters.

(e) Containers for all coatings subject to section (a) shall display the date of manufacture of the contents or a code indicating the date of manufacture. The manufacturers of such coatings shall file with the Executive Officer of the District and the Executive Officer of the California Air Resources Board, prior to September 2, 1981, an explanation of each code. For all coatings manufactured after January 1, 1988, the containers shall also display the maximum volatile organic compound (VOC) content, less water and less exempt solvent. If any thinning is recommended on the label pursuant to section (j) below, the VOC content displayed shall be that after the recommended thinning. The manufacturers of such coatings shall file with the Executive Officer of the District and the Executive Officer of the California Air Resources Board, prior to September 2, 1987, an explanation of each label.

(f) If anywhere on an exempt coating container, or on any sticker or label affixed thereto, or in any sales or advertising literature, any indication is given that such exempt coating may be used or is suitable for use for any purpose other than those specifically provided for in section (c) of this Rule, then the exemption provided for in said section (c) shall not apply to that coating.

(g) In any instance where more than one of the standards set forth in section (a) of this Rule may be applicable, the most restrictive standard shall apply.

(h) A person shall not use, sell, or offer for sale for use in the District, in containers of 0.94 liter (one quart) capacity or larger, any architectural coating containing photochemically reactive solvent, as defined in Rule 102. The provisions of this subsection shall not apply to those coatings in compliance with subsections (a)(1)(A), (B), and (a)(2) of this Rule.

(i) A person shall not thin or dilute any architectural coating with a photochemically reactive solvent, except that thinning of coatings in compliance with subsections (a)(1)(A), (B), and (a)(2) of this Rule is permissible if the volatile organic compound content of such coating after thinning does not exceed the limits specified in the applicable subsections.

(j) Containers for all coatings subject to the requirements of this Rule shall carry a statement of the manufacturer's recommendation regarding thinning of the coating. This recommendation shall not apply to the thinning of architectural coatings with water. The recommendation shall specify that the coating, except Industrial Maintenance, is to be employed without thinning or diluting under normal environmental and application conditions, unless any thinning recommended on the label for

normal environmental and application conditions does not cause a coating to exceed its applicable standard. The recommendation on Industrial Maintenance Coatings containers shall state that the coating may be thinned or diluted in the amount needed to be compatible with the existing application and environmental conditions.

This section applies to coatings, except Industrial Maintenance, manufactured after January 1, 1985 and for Industrial Maintenance Coatings manufactured after January 1, 1986.

(k) The VOC content of coatings subject to the provisions of this Rule shall be determined by the procedure outlined in Rule 107 after the coating has been thinned as recommended on the label for normal environmental and application conditions.

(l) Definitions

For the purpose of this Rule, the following definitions shall apply:

(1) Architectural Coatings

Any coatings applied to stationary structures and their appurtenances, to mobile homes, to pavements, or to curbs.

(2) Below-Ground Wood Preservatives

Heavy-duty coatings formulated solely for the purpose of protecting below ground wood from decay or insect attack and which contain a wood preservative chemical registered by the California Department of Food and Agriculture. These coatings perform their function by penetrating into the wood.

(3) Bituminous Coatings Materials

Black or brownish coating materials, soluble in carbon disulfide, consisting mainly of hydrocarbons and which are obtained from natural deposits, or as residues from the distillation of crude petroleum oils, or of low grades of coal.

(4) Bond Breakers

Coatings whose sole purpose, when applied between layers of concrete, is to prevent the freshly poured top layer of concrete from bonding to the substrate on which it is poured.

(5) Concrete-Curing Compounds

Coatings whose sole purpose is to retard the evaporation of water from the surface of freshly cast concrete, thereby strengthening it.

(6) Dry-Fog Coatings

Coatings which are formulated so that when sprayed, overspray droplets dry before falling on floors and other surfaces.

(7) Enamel Undercoaters

Coatings which are designed to be applied to a new surface over a primer or over a previous coat of paint, in order to improve the seal, provide better adhesion and make a smooth base for non-flat coatings.

(8) Fire Retardant Coatings

Coatings designed to retard fires and which will significantly:

(A) reduce rate of flame spread on the surface of a material to which such a coating has been applied; or

(B) resist ignition when exposed to high temperatures; or

(C) insulate a substrate to which such a coating has been applied and prolong the time required to reach ignition temperature.

(9) Flat Coatings

Coatings which register gloss less than 15 on an 85° meter or less than five on a 60° meter, or which is labeled as a flat coating.

(10) General Primers

Coatings which are intended to be applied to a surface to provide a

firm bond between the substrate and subsequent coats.

(11) General Sealers

Coatings which are intended for use on porous substrates to protect the substrate; to prevent subsequent coatings from being absorbed by the substrate; or to prevent harm to subsequent coatings by materials in the substrate.

(12) General Undercoaters

Coatings which are designed to provide a smooth surface for subsequent coats.

(13) Graphic Arts Coatings (Sign Paints)

Coatings which are marketed solely for application to indoor and outdoor signs, ~~and~~ including lettering enamels, poster colors and bulletin colors.

(14) Industrial Maintenance Primers and Topcoats

Coatings which are intended to be applied to a surface prior to the application of an industrial maintenance topcoat, to provide a firm bond between the substrate and subsequent coats and high performance coatings which are formulated for the purpose of heavy abrasion, water immersion, chemical, corrosion, temperature, electrical or solvent resistance.

(A) Alkyds

Synthetic resins formed by the condensation of polyhydric alcohols with polybasic acids.

(B) Catalyzed Epoxy

Cross-linking resins made by the reaction of epoxides with other materials such as amines, alcohols, phenols, carboxylic acids, and unsaturated compounds.

(C) Bituminous Coatings Materials

Black or brownish coating materials, soluble in carbon disulfide, consisting mainly of hydrocarbons and which are obtained from natural deposits, or any residues from the distillation of crude petroleum oils, or of low grades of coal.

(D) Inorganic Polymers

Substances whose principal structural features are made up on homopolar interlinkages between multivalent elements other than carbon. This does not preclude the presence of carbon-containing groups in the side branches, or as interlinkages between principal structural members. Examples of such polymers are ethyl and butyl silicates.

(E) Vinyl Chloride Polymers

Polymers made by the polymerization of vinyl chloride or copolymerization of vinyl chloride with other unsaturated compounds, the vinyl chloride being in greatest amount by weight.

(F) Chlorinated Rubber

Resin formed by the reaction of rubber with chlorine.

(G) Acrylic Polymers

Polymers resulting from the polymerization of derivatives of acrylic acids, including esters of acrylic acid, methacrylic acid, acrylonitrile, and their copolymers. Also known as acrylic resins and acrylate resins.

(H) Urethane Polymers

Coating vehicles containing a polyisocyanate monomer reacted in such a manner as to yield polymers containing any ratio, proportion, or combination of urethane linkages, active isocyanate groups, or polyisocyanate monomer.

(I) Silicones

A resin containing silicon, unlike organic resins which all contain carbon. The basic structure of silicones consists of silicon-oxygen linkages.

(J) Unique Vehicles

Generic polymer components not defined by any of the preceding, e.g., hypalon or phenoxy.

(15) Lacquer

Clear or pigmented coatings formulated with nitrocellulose or synthetic resins to dry by evaporation without chemical reaction and to provide a quick-drying, solid protective film.

(16) Mastic Texture Coatings

Coatings, except Waterproofing Mastic Coatings, which are formulated to cover holes and minor cracks and to conceal surface irregularities.

(17) Metallic Pigmented Paints

Non-bituminous coatings which are formulated with metallic pigment.

(18) Multi-colored Coatings

Coatings which exhibit more than one color when applied and which are packaged in a single container and applied in a single coat.

(19) Non-flat Coatings

Coatings which register gloss of 15 or greater on an 85° meter or five or greater on a 60° meter, and which are identified on the label as a gloss, semigloss, or eggshell enamel coating.

(20) Opaque Stains

All stains that are not classified as semitransparent stains.

(21) Opaque Wood Preservatives

All wood preservatives not classified as semitransparent wood preservatives.

(22) Quick Dry Primers and Sealers

Primers, sealers, and undercoaters which are intended to be applied to a surface to provide a firm bond between the substrate and subsequent coats and which are dry to touch in one-half hour and can be recoated in two hours (ASTM 1640).

(23) Quick Dry Enamels

Non-flat coatings which comply with the following:

(i) Shall be capable of being applied directly from the container by brush or roller under normal conditions, normal conditions being ambient temperatures between 60°F and 80°F;

(ii) When tested in accordance with ASTM D 1640 they shall: set to touch in two hours or less, dry hard in eight hours or less, and be tack free in four hours or less by the mechanical method test; and

(iii) Shall have a 60° dried film gloss of no less than 70.

(24) Roof Coatings

Coatings which are formulated for the sole purpose of preventing penetration of the substrate by water. These coatings include bituminous roof and waterproof mastic coatings.

(25) SemiTransparent Stains

Coatings which are formulated to change the color of a surface but not conceal the surface.

(26) SemiTransparent Wood Preservatives

Wood preservative stains which are formulated for the purpose of protecting exposed wood from decay or insect attack by the addition of a wood preservative chemical registered by the California Department of Food and Agriculture, and which are formulated to change the color of a surface but not conceal the surface. These

coatings perform their function by penetrating into the wood.

(27) Shellacs

Clear or pigmented coatings formulated with natural resins (except nitrocellulose resins), thinned with alcohol, and formulated to dry by evaporation without a chemical reaction and are intended to provide stain-blocking properties as well as a solid protective film.

(28) Specialty Flat Products

Self-priming flat products used only to perform one of the following functions: repair fire, smoke, or water damage; neutralize odors; block stains; or coat acoustical materials without affecting their acoustical properties.

(29) Specialty Primers, Sealers, and Undercoaters

Primers, sealers, and undercoaters used only to perform one of the following functions: repair fire, smoke, or water damage; neutralize odor; block stains; block efflorescence; condition chalky surfaces; or coat acoustical materials without affecting their acoustical properties.

(30) Swimming Pool Coatings

Coatings specifically formulated to coat the interior of swimming pools and to resist swimming pool chemicals.

(31) Tile-like Glaze Coatings

Coatings which are formulated to provide a tough, extra-durable coating system, which are applied as a continuous (seamless) high-build film, and which cure to a hard-glaze finish.

(32) Varnishes

Clear or pigmented coatings formulated with various resins to dry

by chemical reaction on exposure to air. These coatings are intended to provide a durable transparent or translucent solid protective film.

(33) Volatile Organic Compounds (VOC)

Compounds of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, ammonium carbonate, methane, 1,1,1-trichloroethane, methylene chloride, and trichlorotrifluoroethane, which may be emitted to the atmosphere during the application of and/or subsequent drying or curing of coatings subject to this Rule.

(34) Waterproofing Mastic Coatings

Weatherproof and waterproof coatings which are formulated to cover holes, minor cracks, and conceal surface irregularities and which are applied in thicknesses of at least 15 mils.

(35) Waterproofing Sealers

Coatings which are formulated for the sole purpose of preventing penetration of porous substrates by water.

APPENDIX C:

CEGS-09900[4]: List of Applicable Specifications

Specification	Meets VOC*	Meets Rule 66**	Notes
P-W-155C & Int Am-1	--- ---	yes	Not paint specification
P-W-158E		yes	Not paint specification
TT-C-535B & Am-2	yes	yes (Type II)	Exempt tile-like coating
TT-C-542E	yes	yes	Exempt tile-like coating
TT-C-55OC	yes	yes	Exempt tile-like coating
TT-C-555B	yes	yes	Exempt texture coating
TT-E-487E & Am-1	not controlled	yes	Specification being revised
TT-E-489G	no	yes	High solids version being developed
TT-E-496B & Am-2	not controlled	yes	
TT-E-505A & Am-3	yes (brush)	yes	Thinning for spray exceeds VOC
TT-E-506K & Am-1	yes (brush)	yes	Thinning for spray exceeds VOC

[4]Corps of Engineers Guide Specification CEGS-09900, *General Painting* (USACE March 1986).

*Based on *BRDEC Plan of Action for the Control of 8010 Volatile Organic Compounds in Department of Defense Operations*, which uses SCAQMD's Rule 1113 as being typical of the most restrictive regulation in the continental United States (CONUS).

**Rule 66: although no longer in existence, this California regulation became the pattern for many state and local regulations which are still current.

Specification	Meets VOC	Meets Rule 66	Notes
TT-E-508C & Am-1	yes (brush)	yes	Thinning for spray exceeds VOC
TT-E-509B & Am-2	yes (brush)	yes	Specification being revised
TT-E-543A & Am-1	no	yes	Cancel
TT-E-545B & Am-1	not controlled	yes	Specification being revised
TT-F-1098D	yes	yes	
TT-P-19D	yes	yes	
TT-P-24D & Am-2	yes	yes	
TT-P-28G	not controlled	yes	
TT-P-29J & Am-1	yes	yes	
TT-P-30E & Am-1	no	yes	Cancel
TT-P-31D	yes	yes	
TT-P-37D & Am-4	no	yes	Cancel
TT-P-38D & Am-1	yes	yes	Exempt metallic pigment
TT-P-91D & Am-2	not controlled	yes	
TT-P-95C & Am-1	yes/no	yes	Exempt if used as swimming pool paint
TT-P-102E & Int Am-1	yes	yes	

Specification	Meets VOC	Meets Rule 66	Notes
TT-P-645A	not controlled	yes	
TT-P-650C & Am-1	yes	yes	
TT-P-1510A & Am-1	yes	yes	
TT-P-1511B	yes	yes	
TT-P-00198	yes	yes	
TT-S-176 & Am-1	no	yes	Cancel
TT-S-179B & Am-1	not controlled	yes	
TT-S-708A & Am-2	yes	yes	
TT-S-711C	yes	yes	For wood furniture
TT-S-001992	yes	yes	
TT-V-51F	no	yes	Cancel
TT-V-85C & Am-1 & Int Am-2	yes	yes	For wood furniture
TT-V-86C & Am-2	yes	yes	For wood furniture
TT-V-109C	yes	yes	For wood furniture
TT-V-11 & Am-2	not controlled	yes	
TT-V-121H	no	yes	Cancel
TT-V-119D & Am-2	not controlled		Specification being revised
MIL-S-12935D	no	yes	Cancel

Specification	Meets VOC	Meets Rule 66	Notes
MIL-P-26915B	yes	yes	Exempt metallic pigment
MIL-P-28582	not controlled	yes	
A-A-1500A	yes	yes	
Heavy duty & Gymnasium finishes for Maple, Beech and Birch Floors	not controlled	not controlled	Industry specification
SSPC-Paint 5-82	yes	yes	Exempt metallic pigment
SSPC-Paint 9-82	no	no	Specification being revised
SSPC-Paint 11-82	yes	yes	
SSPC-Paint 18-82	no	no	
SSPC-Paint 21-82	not controlled	yes	
SSPC-Paint 25-82	yes	yes	
SSPC-Paint 27-82	no	yes	

APPENDIX D:

CW-09940[5]: List of Applicable Specifications

Specification	Meets VOC*	Meets Rule 66**	Notes
L-C-530B & Am-1	yes	yes	No solvents
TT-C-535B & Am-2	yes (type II)	yes	Exempt tile-like coating
TT-E-489F & Int Am-1	no	yes	High solids version being developed
TT-E-490E & Am-3	no	yes	Cancel
TT-E-496B & Am-2	not controlled	yes	
TT-E-505A & Am-3	yes (brush)	yes	Thinning for spray exceeds VOC
TT-E-506K	yes (brush)	yes	Thinning spray exceeds VOC
TT-E-508C	yes (brush)	yes	Thinning for spray exceeds VOC
TT-E-509B & Am-2	yes (brush)	yes	Specification being revised
TT-E-529D	no	yes	High solids version being developed
TT-E-543A & Am-1	no	yes	Cancel
TT-E-545B & Am-1	not controlled	yes	Specification being revised
TT-E-1593B	no	yes	Cancel

[5]Corps of Engineers Guide Specification for Civil Works Construction CW-09940 *Painting: Hydraulic Structures and Appurtenant Works* (USACE August 1981).

*Based on *BRDEC Plan of Action for the Control of 8010 Volatile Organic Compounds in Department of Defense Operations*, which uses SCAQMD's Rule 1113 as being typical of the most restrictive regulation in CONUS.

**Rule 66: although no longer in existence, this California regulation became the pattern for many state and local regulations which are still current.

Specification	Meets VOC	Meets Rule 66	Notes
TT-P-28F	not controlled	yes	
TT-P-29J & Am-1	yes	yes	
TT-P-30E	no	yes	Cancel
TT-P-31D	yes	yes	
TT-P-38D & Am-1	yes	yes	Exempt: metallic pigment
TT-P-61E	no	yes	
TT-P-86G	yes	yes	
TT-P-91D & Am-1	not controlled	yes	
TT-P-102E	yes	yes	
TT-P-615D & Am-3	yes	yes	
TT-P-1046A	yes	yes	Exempt: metallic pigment
TT-V-109C	yes	yes	Cancel
DOD-P-15328D	no	yes	Cancel
MIL-C-18480A (DOCKS) & Am-3	yes	yes	(if requested)
DOD-P-21035A (SHIPS)	yes	yes	Exempt: metallic pigment
MIL-C-22750D	not controlled	yes	
MIL-P-24441A (SHIPS) (1-18)	no	yes	High solids version being developed
MIL-P-26915B (USAF)	yes	yes	Exempt: metallic pigment
SSPC-Paint 16-6	no	no	

Specification	Meets VOC	Meets Rule 66	Notes
FORMULATION PAINTS			
V-102C	yes	no	Exempt: metallic pigment
V-103C	no	no	
V-106D	no	no	
VZ-108D	yes	no	Exempt: metallic pigment
V-113	no	no	
V-766E	no	no	
E-303D	yes	yes	Exempt: metallic pigment

APPENDIX E:

CE-R-09.2[6]: List of Applicable Specifications

Specification	Meets VOC*	Meets Rule 66**	Notes
TT-C-542E	yes	yes	Exempt: tile-like coating
TT-C-535B	yes	yes type II	Exempt: tile-like coating
TT-C-55OC & Am-1	yes	yes	Exempt: tile-like coating
TT-C-555B & Am-1	yes	yes	Exempt: texture coating
TT-E-487E	not controlled	yes	Specification being revised
TT-E-489G	no	yes	High solids version being developed
TT-E-505A & Am-3	yes (brush)	yes	Thinning for spray exceeds VOC
TT-E-506K & Am-1	yes (brush)	yes	Thinning for spray exceeds VOC
TT-E-508C	yes (brush)	yes	Thinning for spray exceeds VOC
TT-E-509B & Am-2	yes (brush)	yes	Specification being revised
TT-E-543A & Am-1	no	yes	Cancel

[6]Corps of Engineers Guide Specification for Army Reserves CE-R-09.2, *Painting* (USACE July 1985).

*Based on *BRDEC Plan of Action for the Control of 8010 Volatile Organic Compounds in Department of Defense Operations*, which uses SCAQMD's Rule 1113 as being typical of the most restrictive regulation in CONUS.

**Rule 66: although no longer in existence, this California regulation became the pattern for many state and local regulations which are still current.

Specification	Meets VOC	Meets Rule 66	Notes
TT-E-545B & Am-1	not controlled	yes	Specification being revised
TT-E-1593B	no	yes	Cancel
TT-F-1098B	yes	yes	
TT-P-19C & Am-2	yes	yes	
TT-P-29J & Am-1	yes	yes	
TT-P-30E & Am-1	no	yes	Cancel
TT-P-38D & Am-1	yes	yes	Exempt: metallic coating
TT-P-55B & Am-2	yes	yes	Cancel
TT-P-86G	yes	yes	
TT-P-91D & Am-1	not controlled	yes	
TT-P-95C & Am-1	yes	yes	Exempt: swimming pool coating
TT-P-97D & Int Am-1	no	yes	Cancel
TT-P-102E & Int Am-1	yes	yes	
TT-P-641G & Am-1	yes	yes	Exempt: metallic pigment
TT-P-645A	not controlled	yes	
TT-P-650C & Am-1	yes	yes	
TT-P-1181A & Am-1	no	yes	Cancel
TT-P-1510A & Am-1	yes	yes	

Specification	Meets VOC	Meets Rule 66	Notes
TT-P-1511B	yes	yes	
TT-P-001984	yes	yes	
TT-S-176E & Am-1	no	yes	Cancel
TT-S-179B & Am-1	not controlled	yes	
TT-S-708A & Am-2	yes	yes	
TT-S-001992	yes	yes	
TT-V-51F	no	yes	Cancel
TT-V-85C & Am-1 & Int Am-2	yes	yes	
TT-V-109C	yes	yes	
TT-V-119D & Am-2	not controlled	yes	Specification being revised
TT-V-121H	no	yes	Cancel
MIL-P-26915B	yes	yes	Exempt: metallic pigment
MIL-P-28582	not controlled	yes	
A-A-1500A	yes	yes	

APPENDIX F:

IMPACT OF VOC REGULATIONS ON PAINTING SCHEDULE OF CEGS-09900

In this reproduction of the Painting Schedule from CEGS-09900, specifications for paints which do not comply with the SCAQMD VOC regulations (Rules 1107 and 1113; see Appendices A and B) have been crossed out. Each crossed out paint is discussed in Chapter 5. Those paragraphs give the amounts of VOC and suggest alternative coatings.

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